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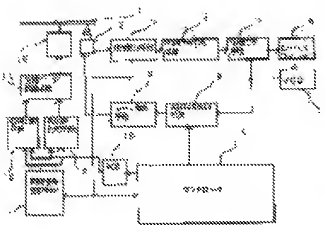
(71)Applicant : SEIKO EPSON CORP
(72)Inventor : SEKI HIDEYA

(54) OPTICAL DISK DEVICE



(57)Abstract:
PROBLEM TO BE SOLVED: To perform high-speed and highly reliable recording by performing control to change the energy per one channel bit of a light irradiating an optical disk according to a linear speed.
SOLUTION: This optical disk device is the one for recording/reproducing information by forming recording pits at a constant linear density, and includes a VCO 7, a recording signal generating means 8, a laser driving means 9 and a controller 10 as a control means. The VCO 7 produces a reference clock having a higher frequency as a linear speed increases in proportion to the linear speed of an optical disk l. The recording signal generating means 8 outputs a data signal in synchronization with the reference clock from the VCO 7, and the laser driving means 9 produces a light source according to the output of the recording signal generating means 8. The controller 10 performs, for forming pits from the light source, control so as to increase the energy per one channel bit of a light projected to the optical disk 1 as a linear speed seen in the position of an optical head 2 is larger and make the size of a bit optimal.

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CLAIMS

[Claim(s)]
[Claim 1] In the optical disk unit which forms a record pit in linear-density regularity, and performs informational record and playback An optical head including the light source, and a basic clock generation means to generate a basic clock with a high frequency in proportion to the linear velocity of an optical disk, so that linear velocity is large, A record signal generation means to synchronize a data signal with said basic clock, and to output it, The light source driving means which makes said light source emit light according to the output of said record signal generation means, The optical disk unit characterized by providing the control means controlled to make so high that the linear velocity seen in the location of said optical head be large energy per one-channel bit of the light irradiated by said optical disk from said light source for pit formation, and to make magnitude of a pit the optimal.
[Claim 2] It is the optical disk unit characterized by being controlled for it to be low when the linear velocity which the height of the pulse of said record signal which is the luminescence wave of said light source saw in the location of said optical head is small in claim 1, and to become high when large.
[Claim 3] It is the optical disk unit characterized by being controlled for it to be narrow when the size to the basic clock of the pulse width of said record signal which is the luminescence section of said light source has a small linear velocity seen in the location of said optical head in claim 1, and to become large when large.

[Claim 4] The energy per one-channel bit of the light irradiated by said optical disk from said light source in claim 1 for pit formation is an optical disk unit characterized by being controlled to carry out proportionally [abbreviation] at the square root of the linear velocity seen in the location of said optical head.

[Claim 5] In claim 1, said light source emits light according to said record signal, and the height of the pulse of said record signal is equivalent to the output of said light source. Pulse width is constituted so that it may be equivalent to the luminescence section of said light source. Said control means It has a storage means to memorize the table which described pulse width to be the height of said pulse which is the optimal to the linear velocity seen in the location of said optical head. The optical disk unit characterized by controlling said record signal to change the height and width of face of a record pulse gradually with reference to said table according to said linear velocity furthermore, and to always form the record pit of the optimal magnitude.

[Claim 6] In claim 1, said light source emits light according to said record signal, and the height of the pulse of said record signal is equivalent to the output of said light source. Pulse width is constituted so that it may be equivalent to the luminescence section of said light source. Said control means It has a storage means to memorize the function expression which gives pulse width to the linear velocity seen in the location of said optical head as the height of said pulse which is the optimal. The optical disk unit characterized by controlling said record signal to change the height and width of face of a record pulse with reference to said function expression according to said linear velocity furthermore, and to always form the optimal record pit.

[Claim 7] In the optical disk unit which forms a record pit in linear-density regularity, and performs informational record and playback It is proportional to linear velocity from an optical head including the light source, and the synchronization information recorded on the optical disk. A basic clock generation means to generate a basic clock with a frequency high [when linear velocity is small, a frequency is low, and] when linear velocity is large. A record signal generation means to synchronize a data signal with said basic clock, and to output it. The light source driving means which makes said light source emit light according to the output of said record signal generation means. The optical disk unit characterized by providing the control means which controls said record signal to always form a record pit in the optimal location even if it delays the timing of the pulse of said record signal and linear velocity changes so that the linear velocity seen in the location of said optical head is small.

[Claim 8] In the optical disk unit which forms a record pit in linear-density regularity, and performs informational record and playback An optical head including the light source, and a record signal generation means to synchronize a data signal with a basic clock, and to change and output to the pulse train of a multiple value further. The light source driving means which makes said light source emit light according to the output of said record signal generation means, The optical disk unit characterized by providing the control means which controls said record signal to change the wave of said pulse train so that the amount of energy which beginning writes, so that the linear velocity seen in the location of said optical head is large may become large, and to always form the record pit of the optimal configuration.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the information storage device using an exchangeable optical disk.
[0002]
[Description of the Prior Art] The rotational frequency of a main shaft motor is usually changed with the location of a head, and it controls by the optical disk in a CLV format so that linear velocity becomes fixed. That is, when a head is in inner circumference, it is high in a rotational frequency, and a rotational frequency is made low when it is in a periphery. On the other hand, the record pit is formed in linear-density regularity. Thereby, the regenerative signal detected with an optical head can be read with the clock of a fixed frequency.
[0003] By the way, in the above control, the rotational frequency of an optical disk must be changed with the location of an optical head. Seek operation has not only migration of an optical head but setting of a rotational frequency, and is completed. Setting of a rotational frequency requires long time amount by the case, and becomes the element which often determines a seek time. A seek time can be shortened if it is not necessary to control such a rotational frequency. Then, in order to realize improvement in the speed at the time of playback, the approach of fixing the rotational frequency of a disk, and changing the frequency of the basic clock of regenerative-signal detection to instead of according to the location of an optical head, and enabling high-speed playback is proposed like JP,06-89506,A or JP,06-12785,A. That is, at the inner circumference by which linear velocity becomes low, on the periphery on which it is low with a periphery and linear velocity becomes high about a clock frequency, if a clock frequency is made high, engine-speed regularity or change of little width of face can also play the disk in a CLV format.
[0004] On the other hand, in order to realize improvement in the speed at the time of record, like JP,08-212691,A, the rotational frequency of a disk is fixed and the approach of changing the frequency of the basic clock of a record signal according to the location of an optical head instead, and enabling high-speed record is proposed. An example of the

configuration is shown in drawing 1111 . Hereafter, according to drawing, fundamental actuation of the conventional optical disk unit is explained.

[0005] An optical disk unit The semiconductor laser which is an optical disk 1 and the light source It uses. To said optical disk 1 a laser beam A signal-processing means 3 to irradiate, to process the signal which read information with the optical head 2 recorded and reproduced and said optical head 2, and to change into a digital signal, a clock generation means 17 to generate the basic clock of a record signal based on the positional information of said optical head 2, the sign and pulse width of a record signal. A laser output It begins. Control of the whole optical disk unit A record signal generation means 8 to generate a record signal based on the command of the controller 10 to perform, and the clock which said clock generation means 17 generates and said controller 10, the laser driving means 9 which makes semiconductor laser emit light according to the signal of said record signal generation means, and said optical disk The signal used as the criteria for rotating a synchronizing signal generation means 11 to generate the synchronizing signal for rotating said main shaft motor at a predetermined rotational frequency, and said main shaft motor, at a fixed rotational frequency from the output of the main shaft motor 15 to rotate and said signal-processing means 3 The frequency of VCO16 to generate, and said synchronizing signal and said VCO16 is compared. It consists of a frequency comparison means 13 to generate an error signal, a phase-comparison means 12 to compare the phase of said synchronizing signal and said VCO16, and to generate an error signal, and a main shaft motorised means 14 to drive a main shaft motor based on said error signal. With this configuration, the rotational frequency of said main shaft motor is always fixed, instead, based on the radius positional information of said optical head 2, the basic clock of said record signal changes by the inside-and-outside periphery, and record of linear-density regularity is made. By the way, by the aforementioned record approach, since linear velocity is not fixed, in order to form a uniform pit, record conditions must be united and optimized to linear velocity. In JP,08-212691,A, record conditions are changing and optimizing the property of a record medium by the inside-and-outside periphery.

[0006]

[Problem(s) to be Solved by the Invention] However, the approach of optimizing record conditions by the record-medium side will need the optical disk of dedication, and is lacking in versatility. Moreover, with the optical disk unit constituted so that it could record in the condition of having deviated from predetermined linear velocity, such as rotation fluctuation of a disk, and a transient in CLV control, it had the technical problem that optimization of record conditions could not be performed, by the aforementioned approach.

[0007]

[Means for Solving the Problem]

(1) In the optical disk unit which the optical disk unit of this invention forms a record pit in linear-density regularity, and performs informational record and playback An optical head including the light source, and a basic clock generation means to generate a basic clock with a high frequency in proportion to the linear velocity of an optical disk, so that linear velocity is large, A record signal generation means to synchronize a data signal with said

basic clock, and to output it. The light source driving means which makes said light source emit light according to the output of said record signal generation means. It is characterized by providing the control means controlled to make so high that the linear velocity seen in the location of said optical head be large energy per one-channel bit of the light irradiated by said optical disk from said light source for pit formation, and to make magnitude of a pit the optimal.

[0008] (2) When the optical disk unit of this invention has a small linear velocity which the height of the pulse of said record signal which is the luminescence wave of said light source saw in the location of said optical head in (1), it is low, and when large, it is characterized by being controlled to become high.

[0009] (3) When the size to the basic clock of the pulse width of said record signal whose optical disk unit of this invention is the luminescence section of said light source in (1) has a small linear velocity seen in the location of said optical head, it is narrow, and when large, it is characterized by being controlled to become large.

[0010] (4) Energy per one-channel bit of light with which the optical disk unit of this invention is irradiated by said optical disk from said light source in (1) for pit formation is characterized by being controlled by the square root of the linear velocity seen in the location of said optical head to carry out proportionally [abbreviation].

[0011] (5) In the optical disk unit of this invention, in (1), said light source emits light according to said record signal. The height of the pulse of said record signal is equivalent to the output of said light source, and pulse width is constituted so that it may be equivalent to the luminescence section of said light source. Said control means It has a storage means to memorize the table which described pulse width to be the height of said pulse which is the optimal to the linear velocity seen in the location of said optical head. Furthermore according to said linear velocity, the height and width of face of a record pulse are gradually changed with reference to said table, and it is characterized by controlling said record signal to always form the record pit of the optimal magnitude.

[0012] (6) In the optical disk unit of this invention, in (1), said light source emits light according to said record signal. The height of the pulse of said record signal is equivalent to the output of said light source, and pulse width is constituted so that it may be equivalent to the luminescence section of said light source. Said control means It has a storage means to memorize the function expression which gives pulse width to the linear velocity seen in the location of said optical head as the height of said pulse which is the optimal. Furthermore according to said linear velocity, the height and width of face of a record pulse are changed with reference to said function expression, and it is characterized by controlling said record signal to always form the optimal record pit.

[0013] (7) In the optical disk unit which the optical disk unit of this invention forms a record pit in linear-density regularity, and performs informational record and playback It is proportional to linear velocity from an optical head including the light source, and the synchronization information recorded on the optical disk. A basic clock generation means to generate a basic clock with a frequency high [when linear velocity is small, a frequency is low, and] when linear velocity is large. A record signal generation means to synchronize a data signal with said basic clock, and to output it. The light source driving means which makes said light source emit light according to the output of said record signal generation

means, Even if it delays the timing of the pulse of said record signal and linear velocity changes so that the linear velocity seen in the location of said optical head is small, it is characterized by providing the control means which controls said record signal to always form a record pit in the optimal location.

[0014] (8) In the optical disk unit which the optical disk unit of this invention forms a record pit in linear-density regularity, and performs informational record and playback An optical head including the light source, and a record signal generation means to synchronize a data signal with a basic clock, and to change and output to the pulse train of a multiple value further, The light source driving means which makes said light source emit light according to the output of said record signal generation means, The wave of said pulse train is changed so that the amount of energy which beginning writes, so that the linear velocity seen in the location of said optical head is large may become large, and it is characterized by providing the control means which controls said record signal to always form the record pit of the optimal configuration.

[0015]

[Embodiment of the Invention]

(Example 1) The example of this invention is shown below and it explains to it using drawing.

[0016] Drawing 1 is the explanatory view showing the configuration of the optical disk unit which is one example of this invention. An optical disk unit The semiconductor laser which is an optical disk 1 and the light source It uses. To said optical disk 1 a laser beam It irradiates. Information The signal read with the optical head 2 recorded and reproduced and said optical head 2 The phase of a signal-processing means 3 to process and to change into a digital signal, a synchronizing signal generation means 4 to extract the synchronizing signal recorded on said optical disk 1 from said digital signal, VCO7 that generates the basic clock which generates a record signal, and said synchronizing signal and said VCO is compared. A phase-comparison means 5 to output an error signal, the low pass filter 6 which passes only the low-frequency component of said error signal, the sign and pulse width of a record signal, A laser output It begins. Control of the whole optical disk unit A record signal generation means 8 to generate a record signal based on the command of the controller 10 to perform, and the clock which said VCO7 generates and said controller 10, the laser driving means 9 which makes semiconductor laser emit light according to the signal of said record signal generation means, and said optical disk At the same time it generates the signal used as the criteria for rotating a synchronizing signal generation means 11 to generate the synchronizing signal for rotating said main shaft motor at a predetermined rotational frequency, and said main shaft motor, at a fixed rotational frequency from the output of the main shaft motor 15 to rotate and said signal-processing means 3 The frequency of VCO16 which determines the target rotational frequency of said main shaft motor 15 in response to the command of said controller 10, and said synchronizing signal and said VCO16 is compared. It consists of a frequency comparison means 13 to generate an error signal, a phase-comparison means 12 to compare the phase of said synchronizing signal and said VCO16, and to generate an error signal, and a main shaft motorised means 14 to drive a main shaft motor based on said error signal.

[0017] First, the drive system of said main shaft motor 15 is explained. Said synchronizing signal generation means 11 generates a synchronizing signal required to rotate said main shaft motor 15 from the output of said frequency comparison means 13. Said synchronizing signal is compared with the output of said VCO16 by said frequency comparison means 13 and said phase-comparison means 12, and an error signal is outputted to said main shaft motorised means 14. Said main shaft motor 15 rotates with the output of said main shaft motorised means 14. Said controller 10 recognizes the location of said optical head 2 from the physical address information in response to the output signal of said signal-processing means 3 here. Furthermore, said VCO16 is controlled to make the rotational frequency of said main shaft motor 15 change according to the location of said optical head 2. That is, when said optical head 2 is in inner circumference, it is high in the rotational frequency of said main shaft motor 15, when said optical head 2 is in a periphery, the rotational frequency of said main shaft motor 15 is made low, and it controls so that linear velocity becomes fixed by the inside-and-outside periphery. This is the same as the conventional CLV control.
[0018] Next, a record signal product is explained. The output of said signal-processing means 3 is first inputted into said synchronizing signal generation means 4. Here, a synchronizing signal required in order to record a record signal on the right location on said optical disk 1 on a predetermined frequency is generated. Said VCO7 generates the basic clock of said record signal. Said phase-comparison means 5 compares the phase of said basic clock and said synchronizing signal, and outputs an error signal. Said low pass filter 6 passes low-pass [of said error signal], and is supplied to said VCO7. Said VCO7 has a sufficiently large capture range, and follows the linear velocity of said optical disk 1 in the large range. Therefore, the output frequency of said VCO7 is high, if it synchronizes with said synchronizing signal and the linear velocity in the location of said optical head 2 becomes quick, and if it becomes late, it will be controlled to become low. Although said linear velocity is originally controlled by this example as mentioned above here to become fixed, in order for modification of the rotational frequency accompanying migration of said optical head at the time of seeking to take time amount, the linear velocity in a transient has deviated from default value. However, since said VCO7 follows this linear-velocity fluctuation in the large range, before said rotational frequency sets, it becomes possible to start record actuation, and the time amount which writing takes can be shortened.
[0019] If the capture range of said VCO7 is still larger, record of linear-density regularity is possible also for CAV control.
[0020] In addition, said synchronizing signal here is obtained from the alignment pattern of for example, a PURIPITTO field. That is, in the optical disk in which a certain kind of record is possible, the alignment pattern used for generating a basic clock required for signal regeneration beforehand is recorded in the concavo-convex pit. Also in the time of record, the synchronizing signal proportional to linear velocity can be obtained by reading this. Moreover, in another optical disk of a certain kind, the slot (groove) which forms the pit on a disk lies in a zigzag line the fixed period (wobbling). As long as it is such a disk by which wobbling was carried out, a synchronizing signal may be generated by carrying out multiplying of the wobble signal.
[0021] Said record signal generation means 8 generates a record signal from the record

data from said controller 10 by using the output of said VCO7 as a basic clock. Said semiconductor laser emits light according to said record signal. Here, in order to form a uniform record pit over the whole disk surface, the energy per one-channel bit of the light irradiated by said optical disk from said semiconductor laser for pit formation must be controlled according to linear velocity. That is, when the linear velocity seen in the location of said optical head is small, it is low, and when large, it must be controlled to make it high. This is also performed by said controller 10.

[0022] There is a method of changing the height of the pulse of said record signal showing the output of said semiconductor laser as one of the concrete approaches. This situation is explained referring to drawing 1 and drawing 2 . First, said linear velocity is recognized by said controller 10 of drawing 1 . For example, the record pulse in the linear velocity of whenever [middle] is set to (a). When it is a bigger linear velocity, (b) and said controller make the height of said record pulse high, and irradiate a stronger laser beam at an optical disk. When it is a on the other hand more small linear velocity, (c) and said controller make the height of said record pulse low, and irradiate a weaker laser beam at an optical disk. By this control, the record pit of uniform magnitude can be formed over the whole surface of a disk.

[0023] (Example 2) Drawing 3 is an explanatory view for explaining other one example of this invention. In order to form a uniform record pit, the height of the pulse of said record signal was changed in the example 1, but as this example shows, the width of face to the basic clock of a pulse may be operated according to linear velocity. That is, if linear velocity becomes quick, it is more long in luminescence pulse width, and if it becomes late, it will control to shorten. This situation is explained referring to drawing 3 R> 3. For example, the record pulse in the linear velocity of whenever [middle] is set to (a). When it is a bigger linear velocity, (b) and said controller enlarge width of face of said record pulse, and irradiate a longer time amount laser beam at an optical disk. When it is a on the other hand more small linear velocity, (c) and said controller make small width of face of said record pulse, and irradiate a shorter time amount laser beam at an optical disk. By this control, the record pit of uniform magnitude can be formed over the whole surface of a disk.

[0024] Since it is the same as that of an example 1 about other actuation, detailed explanation is omitted.

[0025] (Example 3) Drawing 4 is the explanatory view showing other one example of this invention. In order to form a uniform record pit, both the height of the pulse of said record signal and width of face may be operated according to linear velocity. That is, if linear velocity becomes quick, it is high in the height of a record pulse, and more long in width of face, if it becomes late, it is low in the height of a record pulse, and it controls to shorten width of face. This situation is explained referring to drawing 4 . For example, the record pulse in the linear velocity of whenever [middle] is set to (a). When it is a big linear velocity, (b) and said controller are expensive in the height of said record pulse, enlarge width of face and irradiate a stronger laser beam at a long time amount optical disk. On the other hand, when it is a small linear velocity, (c) and said controller are low in the height of said record pulse, make width of face small and irradiate a weaker laser beam at a short time amount optical disk. A more suitable record pit can be formed by this control.

[0026] What is necessary is just to store the height or width of face of a record pulse in said controller as a function which makes linear velocity a parameter, in order to realize the aforementioned control. Or said controller may be made to memorize as a table to linear velocity. For example, the optimum value of width of face is calculated as the height of said record pulse over each linear velocity, and the table which described this as shown in drawing 5 is stored in the storage means of said controller 10. What is necessary is just to constitute so that, as for said controller 10, record conditions may be gradually changed with reference to said table, whenever said linear velocity changes.
[0027] In addition, it may ask for said function and table in an experiment in advance, and they may be memorized as a fixed value at the time of equipment manufacture. However, since it corresponds to an operating environment more flexibly, you may ask for said function and table using the trial writing field of a disk. That is, it tries and writes at the time of disk insertion, record conditions are changed in a field, and trial writing is performed, and it constitutes so that it may memorize for said storage means in quest of [each time] optimum conditions. By this approach, compensation which included with [of the ambient temperature at the time of record, or a disk and an optical head] the rose is attained.
[0028] Since it is the same as that of an example 1 about other actuation, detailed explanation is omitted.
[0029] (Example 4) Drawing 6 is an explanatory view for explaining other one example of this invention. Generally, when an optical spot scans an optical disk top, the energy irradiated is in inverse proportion to the square root of the linear velocity of a disk. Then, when operating the height and width of face of a pulse of said record signal as mentioned above, the energy per one-channel bit of the light irradiated by said optical disk may be controlled to carry out proportionally [abbreviation] to the square root of the linear velocity seen in the location of said optical head. This is explained using drawing 6 . An example of a record pulse is shown in drawing. The height of said record pulse is set to Pw, and width of face is set to Tw. The luminous energy irradiated by said optical disk is proportional to the area shown with the slash. When changing the height and width of face of a record pulse according to linear velocity, whenever this area PwxTw changes the height of a pulse, width of face, or its both to the square root of linear velocity so that it may carry out proportionally [abbreviation], it can write the pit of fixed magnitude to it.
[0030] What is necessary is just to store the height or width of face of a record pulse in said controller 10 of drawing 1 as a function which makes linear velocity a parameter, as the example 3 also described in order to realize the aforementioned control. For example, if energy is changed only in pulse height, the height of a pulse will be controlled to become Pw=kprootv by setting a constant to kp, setting linear velocity as v. Moreover, what is necessary is just to control the width of face of a pulse to become Tw=ktrootv by setting a constant to kt, if energy is changed only with pulse width and it will be PPM record. Moreover, what is necessary is just to control the width of face of a pulse to set to T0 the basic pulse width per [which is decided / die length / of one record pulse / by the multiple of n and a clock in the ****** channel number of bits] one-channel bit, and to set it Tw=n-T0+ (ktroot(v)-k0) considering a constant as kt and k0, if it is PWM record. This formula is Tw=n-T0 in the linear velocity v0 which becomes ktrootv0=k0, and

although pulse width is twice [channel number-of-bits] the basic pulse width T0 simply, if linear velocity exceeds v0, it means controlling so that only ktrootv increases pulse width.

[0031] Moreover, in the aforementioned control, the height or width of face of a record pulse may be stored in said controller 10 as a table to linear velocity. What is necessary is for said PwxTw to make the storage means of said said controller 10 memorize the table which described the value of width of face to be the height of a pulse to the square root of linear velocity so that it might carry out proportionally [abbreviation], and just to constitute so that record conditions may be gradually changed with reference to said table, whenever said linear velocity changes.

[0032] Thus, if it is made to record with the energy according to change of linear velocity, an always proper record pit can be formed.

[0033] By the way, generally said linear velocity is computed from address information and said rotational frequency in said controller 10 interior. However, in the optical disk recorded on linear-density regularity, said synchronizing signal is recorded on fixed spacing, and can ask for linear velocity directly from the frequency. then, a basis [what / carried out frequency-electrical-potential-difference conversion of said synchronizing signal] -- carrying out -- direct -- said laser appearance -- powerful -- it is -- you may constitute so that said record pulse width may be decided. According to this approach, record conditions can be rationalized by easier circuitry.

[0034] moreover, instead of carrying out frequency-electrical-potential-difference conversion of said synchronizing signal -- this -- counting -- the same -- linear velocity -- asking -- the actuation same in digital one -- carrying out -- direct -- said laser appearance -- powerful -- it is -- you may ask for said record pulse width. According to this approach, since control of record conditions can be processed in digital one inside a controller, it is not necessary to cause the increment in components mark.

[0035] Since it is the same as that of an example 1 about other actuation, detailed explanation is omitted.

[0036] (Example 5) Drawing 7 is an explanatory view for explaining other one example of this invention.

[0037] A location gap of a pit may take place at the time of modification of said record pulse width. This is explained using drawing 7 . (a) and (b) express the relation between the record pulse in inner circumference and a periphery, a record pit, and a regenerative signal all over drawing, respectively. Since linear velocity is large compared with (a), (b) takes much energy with heating. Then, it compensates by extending pulse width relatively as mentioned above. However, if this actuation is performed, the location of a pit will be shifted in the direction which extended pulse width. Moreover, a pit configuration also changes. This leads to the peak shift of a regenerative signal, and causes a jitter. If this can be amended, more reliable record will be attained.

[0038] then, the aforementioned shift can be amended if it controls to change modification of said record pulse width, simultaneously the timing [begin] which a pit writes. That is, when pulse width is extended, it can prevent that carry out timing which beginning writes to coincidence early, and the location of a pit shifts. What is necessary is just to extend to what starts the table or function which determines the above-mentioned record

conditions only not only in the height of a pulse, and width of face, and specifically gives the parameter of timing. (c) added the actuation which amends the timing which beginning writes to (b). The location of a pit is amended and the same regenerative signal as (a) comes to be acquired. The jitter property at the time of extending pulse width and optimizing record conditions by this, can be raised.

[0039] Since it is the same as that of an example 1 about other actuation, detailed explanation is omitted.

[0040] (Example 6) Drawing 8 is the explanatory view showing the configuration of the optical disk unit which is other one example of this invention.

[0041] In a recordable optical disk, pulse-train record using a luminescence wave as often shown in drawing 8 is performed. This divides a record pulse into fine pulses, such as a 1/2 more channel bit, changes the number of partitions with the die length of a pulse, optimizes a heating profile, and prepares a pit configuration. Moreover, multiple-value control of each value Pwo, i.e., the light peak power, the erasion power Peo, the light bottom power Pbo, etc. of said record pulse is carried out. Moreover, said record signal generation means 8 performs conversion to said pulse train.

[0042] In pulse-train record, the wave of said pulse train can be changed and record conditions can be changed in accordance with change of linear velocity. Drawing 9 expresses typically the relation between the record pulse of (b), and the formed pit, when linear velocity is small, and (a) and linear velocity are large. Here, a pulse train presupposes that it optimizes by (a). If a laser beam is irradiated at a disk when linear velocity is slow, temperature will rise comparatively quickly. Therefore, the normal pit is formed in (a). However, since a temperature rise will take time amount if it is going to record by the same pulse train when linear velocity is quick as shown in (b), a pit will become the blunt thing of a standup. Then, continuation luminescence is carried out like (b') beginning to write, and quickly, temperature is raised and it changes into a pulse train which is made to emit light intermittently after that. Then, the same pit as (a) can be formed.

[0043] Moreover, the height of a pulse may be controlled. Other examples of a pulse train are shown in drawing 1010 . By drawing 10 , Pwo is divided into Pwo1 and Pwo2 among Pwo of drawing 8 , Peo, and Pbo3 value, and the wave controlled still more finely is shown. Generally, a record pit becomes the tear type to which it wrote and the end side swelled by ******** in many cases. Then, in order to amend a pit configuration by making quick heating of beginning to write, the aforementioned pulse-train record is performed. In order to perform this still more effectively, the height Pwo1 of the pulse which beginning writes may be written, and may be made higher than Pwo2 of the end. Furthermore, a uniform pit can be formed if each value is changed according to linear velocity.

[0044] In addition, a setup of the parameter of these pulse trains is good also by the approach of giving functionally also by the approach of quoting from a table as mentioned above. Thereby, according to linear velocity, the always optimal pit can be formed also by the record using a pulse train.

[0045] Since it is the same as that of an example 1 about other actuation, detailed explanation is omitted.

[0046]

[Effect of the Invention] According to this invention, the effectiveness taken below is brought about.
[0047] (1) Since it controls by the optical disk unit of this invention of claim 1 to change the energy per one-channel bit of the light irradiated by said optical disk for pit formation according to linear velocity from said light source, the record pit of uniform magnitude can be formed over the whole surface of a disk.
[0048] (2) Since it controls by the optical disk unit of this invention of claim 2 to change the height of the pulse of a record signal according to linear velocity, the record pit of uniform magnitude can be formed over the whole surface of a disk.
[0049] (3) Since it controls by the optical disk unit of this invention of claim 3 to change the width of face of the pulse of a record signal according to linear velocity, the record pit of uniform magnitude can be too formed over the whole surface of a disk.
[0050] Moreover, when it controls to change both the height of the pulse of a record signal, and width of face according to linear velocity, the record pit of uniform magnitude can be further formed over the whole surface of a disk.
[0051] moreover, a basis [what / carried out frequency-electrical-potential-difference conversion of the synchronizing signal] -- carrying out -- direct -- said laser appearance -- powerful -- it is -- when it asks for said record pulse width, record conditions can be rationalized by easier circuitry.
[0052] moreover, a basis [what / counted said synchronizing signal] -- carrying out -- direct -- said laser appearance -- powerful -- it is -- since control of record conditions can be processed in digital one inside a controller when it asks for said record pulse width, it is not necessary to cause the increment in components mark
[0053] (4) In the optical disk unit of this invention of claim 4, since the energy per one-channel bit of the light irradiated by the optical disk is controlled to the square root of the linear velocity seen in the location of an optical head to carry out proportionally [abbreviation], the record pit of uniform magnitude can be more rationally formed over the whole surface of a disk.
[0054] (5) In the optical disk unit of this invention of claim 5 It has a storage means to memorize the table which described pulse width to be the height of said pulse which is the optimal to the linear velocity seen in the location of said optical head. Furthermore according to said linear velocity, the height and width of face of a record pulse are gradually changed with reference to said table, and since said record signal is controlled to always form the record pit of the optimal magnitude, a setup of warmer record conditions is attained.
[0055] (6) In the optical disk unit of this invention of claim 6 Said control means has a storage means to memorize the function expression which gives pulse width to the linear velocity seen in the location of said optical head as the height of said pulse which is the optimal. Furthermore according to said linear velocity, the height and width of face of a record pulse are changed with reference to said function expression, and since said record signal is controlled to always form the optimal record pit, record conditions are memorizable with storage capacity smaller than the optical disk unit of claim 5. Moreover, record conditions can be changed continuously.
[0056] (7) Since it controls by the optical disk unit of this invention of claim 7 to change

the timing of the standup of a pulse into modification and coincidence of said record pulse width, the location of a pit is amended and more reliable record is attained with a good jitter property.
[0057] (8) Like the optical disk unit of this invention of claim 8, the always optimal pit can be formed by changing wave-like selection and a setup of each parameter also in the record using a pulse train.

[Translation done.]

TECHNICAL FIELD

[Field of the Invention] This invention relates to the information storage device using an exchangeable optical disk.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the information storage device using an exchangeable optical disk

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[Translation done.]

PRIOR ART

[Description of the Prior Art] The rotational frequency of a main shaft motor is usually changed with the location of a head, and it controls by the optical disk in a CLV format so that linear velocity becomes fixed. That is, when a head is in inner circumference, it is high in a rotational frequency, and a rotational frequency is made low when it is in a periphery. On the other hand, the record pit is formed in linear-density regularity. Thereby, the regenerative signal detected with an optical head can be read with the clock of a fixed frequency.
[0003] By the way, in the above control, the rotational frequency of an optical disk must be changed with the location of an optical head. Seek operation has not only migration of an optical head but setting of a rotational frequency, and is completed. Setting of a rotational frequency requires long time amount by the case, and becomes the element which often determines a seek time. A seek time can be shortened if it is not necessary to control such a rotational frequency. Then, in order to realize improvement in the speed at the time of playback, the approach of fixing the rotational frequency of a disk, and changing the frequency of the basic clock of regenerative-signal detection to instead of according to the location of an optical head, and enabling high-speed playback is proposed like JP,08-89506,A or JP,06-12785,A. That is, at the inner circumference by which linear velocity becomes low, on the periphery on which it is low with a periphery and linear velocity becomes high about a clock frequency, if a clock frequency is made high, engine-speed regularity or change of little width of face can also play the disk in a CLV format.
[0004] On the other hand, in order to realize improvement in the speed at the time of record, like JP,08-212691,A, the rotational frequency of a disk is fixed and the approach of changing the frequency of the basic clock of a record signal according to the location of an optical head instead, and enabling high-speed record is proposed. An example of the configuration is shown in drawing 1111 . Hereafter, according to drawing, fundamental actuation of the conventional optical disk unit is explained.
[0005] An optical disk unit The semiconductor laser which is an optical disk 1 and the light source It uses. To said optical disk 1 a laser beam A signal-processing means 3 to irradiate, to process the signal which read information with the optical head 2 recorded and reproduced and said optical head 2, and to change into a digital signal, a clock generation means 17 to generate the basic clock of a record signal based on the positional information of said optical head 2, the sign and pulse width of a record signal. A

laser output It begins. Control of the whole optical disk unit A record signal generation means 8 to generate a record signal based on the command of the controller 10 to perform, and the clock which said clock generation means 17 generates and said controller 10, the laser driving means 9 which makes semiconductor laser emit light according to the signal of said record signal generation means, and said optical disk The signal used as the criteria for rotating a synchronizing signal generation means 11 to generate the synchronizing signal for rotating said main shaft motor at a predetermined rotational frequency, and said main shaft motor, at a fixed rotational frequency from the output of the main shaft motor 15 to rotate and said signal-processing means 3 The frequency of VCO16 to generate, and said synchronizing signal and said VCO16 is compared. It consists of a frequency comparison means 13 to generate an error signal, a phase-comparison means 12 to compare the phase of said synchronizing signal and said VCO16, and to generate an error signal, and a main shaft motorised means 14 to drive a main shaft motor based on said error signal. With this configuration, the rotational frequency of said main shaft motor is always fixed, instead, based on the radius positional information of said optical head 2, the basic clock of said record signal changes by the inside-and-outside periphery, and record of linear-density regularity is made. By the way, by the aforementioned record approach, since linear velocity is not fixed, in order to form a uniform pit, record conditions must be united and optimized to linear velocity. In JP,08-212691,A, record conditions are changing and optimizing the property of a record medium by the inside-and-outside periphery.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] According to this invention, the effectiveness taken below is brought about.
[0047] (1) Since it controls by the optical disk unit of this invention of claim 1 to change the energy per one-channel bit of the light irradiated by said optical disk for pit formation according to linear velocity from said light source, the record pit of uniform magnitude can be formed over the whole surface of a disk.
[0048] (2) Since it controls by the optical disk unit of this invention of claim 2 to change the height of the pulse of a record signal according to linear velocity, the record pit of

uniform magnitude can be formed over the whole surface of a disk.
[0049] (3) Since it controls by the optical disk unit of this invention of claim 3 to change the width of face of the pulse of a record signal according to linear velocity, the record pit of uniform magnitude can be too formed over the whole surface of a disk.
[0050] Moreover, when it controls to change both the height of the pulse of a record signal, and width of face according to linear velocity, the record pit of uniform magnitude can be further formed over the whole surface of a disk.
[0051] moreover, a basis [what / carried out frequency-electrical-potential-difference conversion of the synchronizing signal] -- carrying out -- direct -- said laser appearance -- powerful -- it is -- when it asks for said record pulse width, record conditions can be rationalized by easier circuitry.
[0052] moreover, a basis [what / counted said synchronizing signal] -- carrying out -- direct -- said laser appearance -- powerful -- it is -- since control of record conditions can be processed in digital one inside a controller when it asks for said record pulse width, it is not necessary to cause the increment in components mark
[0053] (4) In the optical disk unit of this invention of claim 4, since the energy per one-channel bit of the light irradiated by the optical disk is controlled to the square root of the linear velocity seen in the location of an optical head to carry out proportionally [abbreviation], the record pit of uniform magnitude can be more rationally formed over the whole surface of a disk.
[0054] (5) In the optical disk unit of this invention of claim 5 It has a storage means to memorize the table which described pulse width to be the height of said pulse which is the optimal to the linear velocity seen in the location of said optical head. Furthermore according to said linear velocity, the height and width of face of a record pulse are gradually changed with reference to said table, and since said record signal is controlled to always form the record pit of the optimal magnitude, a setup of warmer record conditions is attained.
[0055] (6) In the optical disk unit of this invention of claim 6 Said control means has a storage means to memorize the function expression which gives pulse width to the linear velocity seen in the location of said optical head as the height of said pulse which is the optimal. Furthermore according to said linear velocity, the height and width of face of a record pulse are changed with reference to said function expression, and since said record signal is controlled to always form the optimal record pit, record conditions are memorizable with storage capacity smaller than the optical disk unit of claim 5. Moreover, record conditions can be changed continuously.
[0056] (7) Since it controls by the optical disk unit of this invention of claim 7 to change the timing of the standup of a pulse into modification and coincidence of said record pulse width, the location of a pit is amended and more reliable record is attained with a good jitter property.
[0057] (8) Like the optical disk unit of this invention of claim 8, the always optimal pit can be formed by changing wave-like selection and a setup of each parameter also in the record using a pulse train.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, the approach of optimizing record conditions by the record-medium side will need the optical disk of dedication, and is lacking in versatility. Moreover, with the optical disk unit constituted so that it could record in the condition of having deviated from predetermined linear velocity, such as rotation fluctuation of a disk, and a transient in CLV control, it had the technical problem that optimization of record conditions could not be performed, by the aforementioned approach.

[Translation done.]

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MEANS

[Means for Solving the Problem]
(1) In the optical disk unit which the optical disk unit of this invention forms a record pit in linear-density regularity, and performs informational record and playback An optical head including the light source, and a basic clock generation means to generate a basic clock with a high frequency in proportion to the linear velocity of an optical disk, so that linear velocity is large. A record signal generation means to synchronize a data signal with said basic clock, and to output it. The light source driving means which makes said light source emit light according to the output of said record signal generation means. It is

characterized by providing the control means controlled to make so high that the linear velocity seen in the location of said optical head be large energy per one-channel bit of the light irradiated by said optical disk from said light source for pit formation, and to make magnitude of a pit the optimal.

[0008] (2) When the optical disk unit of this invention has a small linear velocity which the height of the pulse of said record signal which is the luminescence wave of said light source saw in the location of said optical head in (1), it is low, and when large, it is characterized by being controlled to become high.

[0009] (3) When the size to the basic clock of the pulse width of said record signal whose optical disk unit of this invention is the luminescence section of said light source in (1) has a small linear velocity seen in the location of said optical head, it is narrow, and when large, it is characterized by being controlled to become large.

[0010] (4) Energy per one-channel bit of light with which the optical disk unit of this invention is irradiated by said optical disk from said light source in (1) for pit formation is characterized by being controlled by the square root of the linear velocity seen in the location of said optical head to carry out proportionally [abbreviation].

[0011] (5) In the optical disk unit of this invention, in (1), said light source emits light according to said record signal. The height of the pulse of said record signal is equivalent to the output of said light source, and pulse width is constituted so that it may be equivalent to the luminescence section of said light source. Said control means It has a storage means to memorize the table which described pulse width to be the height of said pulse which is the optimal to the linear velocity seen in the location of said optical head. Furthermore according to said linear velocity, the height and width of face of a record pulse are gradually changed with reference to said table, and it is characterized by controlling said record signal to always form the record pit of the optimal magnitude.

[0012] (6) In the optical disk unit of this invention, in (1), said light source emits light according to said record signal. The height of the pulse of said record signal is equivalent to the output of said light source, and pulse width is constituted so that it may be equivalent to the luminescence section of said light source. Said control means It has a storage means to memorize the function expression which gives pulse width to the linear velocity seen in the location of said optical head as the height of said pulse which is the optimal. Furthermore according to said linear velocity, the height and width of face of a record pulse are changed with reference to said function expression, and it is characterized by controlling said record signal to always form the optimal record pit.

[0013] (7) In the optical disk unit which the optical disk unit of this invention forms a record pit in linear-density regularity, and performs informational record and playback It is proportional to linear velocity from an optical head including the light source, and the synchronization information recorded on the optical disk. A basic clock generation means to generate a basic clock with a frequency high [when linear velocity is small, a frequency is low, and] when linear velocity is large, A record signal generation means to synchronize a data signal with said basic clock, and to output it, The light source driving means which makes said light source emit light according to the output of said record signal generation means, Even if it delays the timing of the pulse of said record signal and linear velocity changes so that the linear velocity seen in the location of said optical head is small, it is

characterized by providing the control means which controls said record signal to always form a record pit in the optimal location.

[0014] (8) In the optical disk unit which the optical disk unit of this invention forms a record pit in linear-density regularity, and performs informational record and playback An optical head including the light source, and a record signal generation means to synchronize a data signal with a basic clock, and to change and output to the pulse train of a multiple value further, The light source driving means which makes said light source emit light according to the output of said record signal generation means, The wave of said pulse train is changed so that the amount of energy which beginning writes, so that the linear velocity seen in the location of said optical head is large may become large, and it is characterized by providing the control means which controls said record signal to always form the record pit of the optimal configuration.

[0015]

[Embodiment of the Invention]

(Example 1) The example of this invention is shown below and it explains to it using drawing.

[0016] Drawing 1 is the explanatory view showing the configuration of the optical disk unit which is one example of this invention. An optical disk unit The semiconductor laser which is an optical disk 1 and the light source It uses. To said optical disk 1 a laser beam It irradiates. Information The signal read with the optical head 2 recorded and reproduced and said optical head 2 The phase of a signal-processing means 3 to process and to change into a digital signal, a synchronizing signal generation means 4 to extract the synchronizing signal recorded on said optical disk 1 from said digital signal, VCO7 that generates the basic clock which generates a record signal, and said synchronizing signal and said VCO is compared. A phase-comparison means 5 to output an error signal, the low pass filter 6 which passes only the low-frequency component of said error signal, the sign and pulse width of a record signal, A laser output It begins. Control of the whole optical disk unit A record signal generation means 8 to generate a record signal based on the command of the controller 10 to perform, and the clock which said VCO7 generates and said controller 10, the laser driving means 9 which makes semiconductor laser emit light according to the signal of said record signal generation means, and said optical disk At the same time it generates the signal used as the criteria for rotating a synchronizing signal generation means 11 to generate the synchronizing signal for rotating said main shaft motor at a predetermined rotational frequency, and said main shaft motor, at a fixed rotational frequency from the output of the main shaft motor 15 to rotate and said signal-processing means 3 The frequency of VCO16 which determines the target rotational frequency of said main shaft motor 15 in response to the command of said controller 10, and said synchronizing signal and said VCO16 is compared. It consists of a frequency comparison means 13 to generate an error signal, a phase-comparison means 12 to compare the phase of said synchronizing signal and said VCO16, and to generate an error signal, and a main shaft motorised means 14 to drive a main shaft motor based on said error signal.

[0017] First, the drive system of said main shaft motor 15 is explained. Said synchronizing signal generation means 11 generates a synchronizing signal required to rotate said main

shaft motor 15 from the output of said frequency comparison means 13. Said synchronizing signal is compared with the output of said VCO16 by said frequency comparison means 13 and said phase-comparison means 12, and an error signal is outputted to said main shaft motorised means 14. Said main shaft motor 15 rotates with the output of said main shaft motorised means 14. Said controller 10 recognizes the location of said optical head 2 from the physical address information in response to the output signal of said signal-processing means 3 here. Furthermore, said VCO16 is controlled to make the rotational frequency of said main shaft motor 15 change according to the location of said optical head 2. That is, when said optical head 2 is in inner circumference, it is high in the rotational frequency of said main shaft motor 15, when said optical head 2 is in a periphery, the rotational frequency of said main shaft motor 15 is made low, and it controls so that linear velocity becomes fixed by the inside-and-outside periphery. This is the same as the conventional CLV control.

[0018] Next, a record signal product is explained. The output of said signal-processing means 3 is first inputted into said synchronizing signal generation means 4. Here, a synchronizing signal required in order to record a record signal on the right location on said optical disk 1 on a predetermined frequency is generated. Said VCO7 generates the basic clock of said record signal. Said phase-comparison means 5 compares the phase of said basic clock and said synchronizing signal, and outputs an error signal. Said low pass filter 6 passes low-pass [of said error signal], and is supplied to said VCO7. Said VCO7 has a sufficiently large capture range, and follows the linear velocity of said optical disk 1 in the large range. Therefore, the output frequency of said VCO7 is high, if it synchronizes with said synchronizing signal and the linear velocity in the location of said optical head 2 becomes quick, and if it becomes late, it will be controlled to become low. Although said linear velocity is originally controlled by this example as mentioned above here to become fixed, in order for modification of the rotational frequency accompanying migration of said optical head at the time of seeking to take time amount, the linear velocity in a transient has deviated from default value. However, since said VCO7 follows this linear-velocity fluctuation in the large range, before said rotational frequency sets, it becomes possible to start record actuation, and the time amount which writing takes can be shortened.

[0019] If the capture range of said VCO7 is still larger, record of linear-density regularity is possible also for CAV control.

[0020] In addition, said synchronizing signal here is obtained from the alignment pattern of for example, a PURIPITTO field. That is, in the optical disk in which a certain kind of record is possible, the alignment pattern used for generating a basic clock required for signal regeneration beforehand is recorded in the concavo-convex pit. Also in the time of record, the synchronizing signal proportional to linear velocity can be obtained by reading this. Moreover, in another optical disk of a certain kind, the slot (groove) which forms the pit on a disk lies in a zigzag line the fixed period (wobbling). As long as it is such a disk by which wobbling was carried out, a synchronizing signal may be generated by carrying out multiplying of the wobble signal.

[0021] Said record signal generation means 8 generates a record signal from the record data from said controller 10 by using the output of said VCO7 as a basic clock. Said semiconductor laser emits light according to said record signal. Here, in order to form a

uniform record pit over the whole disk surface, the energy per one-channel bit of the light irradiated by said optical disk from said semiconductor laser for pit formation must be controlled according to linear velocity. That is, when the linear velocity seen in the location of said optical head is small, it is low, and when large, it must be controlled to make it high. This is also performed by said controller 10.

[0022] There is a method of changing the height of the pulse of said record signal showing the output of said semiconductor laser as one of the concrete approaches. This situation is explained referring to drawing 1 and drawing 2 . First, said linear velocity is recognized by said controller 10 of drawing 1 . For example, the record pulse in the linear velocity of whenever [middle] is set to (a). When it is a bigger linear velocity, (b) and said controller make the height of said record pulse high, and irradiate a stronger laser beam at an optical disk. When it is a on the other hand more small linear velocity, (c) and said controller make the height of said record pulse low, and irradiate a weaker laser beam at an optical disk. By this control, the record pit of uniform magnitude can be formed over the whole surface of a disk.

[0023] (Example 2) Drawing 3 is an explanatory view for explaining other one example of this invention. In order to form a uniform record pit, the height of the pulse of said record signal was changed in the example 1, but as this example shows, the width of face to the basic clock of a pulse may be operated according to linear velocity. That is, if linear velocity becomes quick, it is more long in luminescence pulse width, and if it becomes late, it will control to shorten. This situation is explained referring to drawing 3 R> 3. For example, the record pulse in the linear velocity of whenever [middle] is set to (a). When it is a bigger linear velocity, (b) and said controller enlarge width of face of said record pulse, and irradiate a longer time amount laser beam at an optical disk. When it is a on the other hand more small linear velocity, (c) and said controller make small width of face of said record pulse, and irradiate a shorter time amount laser beam at an optical disk. By this control, the record pit of uniform magnitude can be formed over the whole surface of a disk.

[0024] Since it is the same as that of an example 1 about other actuation, detailed explanation is omitted.

[0025] (Example 3) Drawing 4 is the explanatory view showing other one example of this invention. In order to form a uniform record pit, both the height of the pulse of said record signal and width of face may be operated according to linear velocity. That is, if linear velocity becomes quick, it is high in the height of a record pulse, and more long in width of face, if it becomes late, it is low in the height of a record pulse, and it controls to shorten width of face. This situation is explained referring to drawing 4 . For example, the record pulse in the linear velocity of whenever [middle] is set to (a). When it is a big linear velocity, (b) and said controller are expensive in the height of said record pulse, enlarge width of face and irradiate a stronger laser beam at a long time amount optical disk. On the other hand, when it is a small linear velocity, (c) and said controller are low in the height of said record pulse, make width of face small and irradiate a weaker laser beam at a short time amount optical disk. A more suitable record pit can be formed by this control.

[0026] What is necessary is just to store the height or width of face of a record pulse in said controller as a function which makes linear velocity a parameter, in order to realize

the aforementioned control. Or said controller may be made to memorize as a table to linear velocity. For example, the optimum value of width of face is calculated as the height of said record pulse over each linear velocity, and the table which described this as shown in drawing 5 is stored in the storage means of said controller 10. What is necessary is just to constitute so that, as for said controller 10, record conditions may be gradually changed with reference to said table, whenever said linear velocity changes.
[0027] In addition, it may ask for said function and table in an experiment in advance, and they may be memorized as a fixed value at the time of equipment manufacture. However, since it corresponds to an operating environment more flexibly, you may ask for said function and table using the trial writing field of a disk. That is, it tries and writes at the time of disk insertion, record conditions are changed in a field, and trial writing is performed, and it constitutes so that it may memorize for said storage means in quest of [each time] optimum conditions. By this approach, compensation which included with [of the ambient temperature at the time of record, or a disk and an optical head] the rose is attained.
[0028] Since it is the same as that of an example 1 about other actuation, detailed explanation is omitted.
[0029] (Example 4) Drawing 6 is an explanatory view for explaining other one example of this invention. Generally, when an optical spot scans an optical disk top, the energy irradiated is in inverse proportion to the square root of the linear velocity of a disk. Then, when operating the height and width of face of a pulse of said record signal as mentioned above, the energy per one-channel bit of the light irradiated by said optical disk may be controlled to carry out proportionally [abbreviation] to the square root of the linear velocity seen in the location of said optical head. This is explained using drawing 6 . An example of a record pulse is shown in drawing. The height of said record pulse is set to Pw, and width of face is set to Tw. The luminous energy irradiated by said optical disk is proportional to the area shown with the slash. When changing the height and width of face of a record pulse according to linear velocity, whenever this area PwxTw changes the height of a pulse, width of face, or its both to the square root of linear velocity so that it may carry out proportionally [abbreviation], it can write the pit of fixed magnitude to it.
[0030] What is necessary is just to store the height or width of face of a record pulse in said controller 10 of drawing 1 as a function which makes linear velocity a parameter, as the example 3 also described in order to realize the aforementioned control. For example, if energy is changed only in pulse height, the height of a pulse will be controlled to become Pw=kprootv by setting a constant to kp, setting linear velocity as v. Moreover, what is necessary is just to control the width of face of a pulse to become Tw=ktrootv by setting a constant to kt, if energy is changed only with pulse width and it will be PPM record. Moreover, what is necessary is just to control the width of face of a pulse to set to T0 the basic pulse width per [which is decided / die length / of one record pulse / by the multiple of n and a clock in the ****** channel number of bits] one-channel bit, and to set it Tw=n-T0+ (ktroot(v)-k0) considering a constant as kt and k0, if it is PWM record. This formula is Tw=n-T0 in the linear velocity v0 which becomes ktrootv0=k0, and although pulse width is twice [channel number-of-bits] the basic pulse width T0 simply, if linear velocity exceeds v0, it means controlling so that only ktrootv increases pulse

width.

[0031] Moreover, in the aforementioned control, the height or width of face of a record pulse may be stored in said controller 10 as a table to linear velocity. What is necessary is for said PwxTw to make the storage means of said said controller 10 memorize the table which described the value of width of face to be the height of a pulse to the square root of linear velocity so that it might carry out proportionally [abbreviation], and just to constitute so that record conditions may be gradually changed with reference to said table, whenever said linear velocity changes.

[0032] Thus, if it is made to record with the energy according to change of linear velocity, an always proper record pit can be formed.

[0033] By the way, generally said linear velocity is computed from address information and said rotational frequency in said controller 10 interior. However, in the optical disk recorded on linear-density regularity, said synchronizing signal is recorded on fixed spacing, and can ask for linear velocity directly from the frequency. then, a basis [what / carried out frequency-electrical-potential-difference conversion of said synchronizing signal] -- carrying out -- direct -- said laser appearance -- powerful -- it is -- you may constitute so that said record pulse width may be decided. According to this approach, record conditions can be rationalized by easier circuitry.

[0034] moreover, instead of carrying out frequency-electrical-potential-difference conversion of said synchronizing signal -- this -- counting -- the same -- linear velocity -- asking -- the actuation same in digital one -- carrying out -- direct -- said laser appearance -- powerful -- it is -- you may ask for said record pulse width. According to this approach, since control of record conditions can be processed in digital one inside a controller, it is not necessary to cause the increment in components mark.

[0035] Since it is the same as that of an example 1 about other actuation, detailed explanation is omitted.

[0036] (Example 5) Drawing 7 is an explanatory view for explaining other one example of this invention.

[0037] A location gap of a pit may take place at the time of modification of said record pulse width. This is explained using drawing 7 . (a) and (b) express the relation between the record pulse in inner circumference and a periphery, a record pit, and a regenerative signal all over drawing, respectively. Since linear velocity is large compared with (a), (b) takes much energy with heating. Then, it compensates by extending pulse width relatively as mentioned above. However, if this actuation is performed, the location of a pit will be shifted in the direction which extended pulse width. Moreover, a pit configuration also changes. This leads to the peak shift of a regenerative signal, and causes a jitter. If this can be amended, more reliable record will be attained.

[0038] then, the aforementioned shift can be amended if it controls to change modification of said record pulse width, simultaneously the timing [begin] which a pit writes. That is, when pulse width is extended, it can prevent that carry out timing which beginning writes to coincidence early, and the location of a pit shifts. What is necessary is just to extend to what starts the table or function which determines the above-mentioned record conditions only not only in the height of a pulse, and width of face, and specifically gives the parameter of timing. (c) added the actuation which amends the timing which beginning

writes to (b). The location of a pit is amended and the same regenerative signal as (a) comes to be acquired. The jitter property at the time of extending pulse width and optimizing record conditions by this, can be raised.
[0039] Since it is the same as that of an example 1 about other actuation, detailed explanation is omitted.
[0040] (Example 6) Drawing 8 is the explanatory view showing the configuration of the optical disk unit which is other one example of this invention.
[0041] In a recordable optical disk, pulse-train record using a luminescence wave as often shown in drawing 8 is performed. This divides a record pulse into fine pulses, such as a 1/2 more channel bit, changes the number of partitions with the die length of a pulse, optimizes a heating profile, and prepares a pit configuration. Moreover, multiple-value control of each value Pwo, i.e., the light peak power, the erasion power Peo, the light bottom power Pbo, etc. of said record pulse is carried out. Moreover, said record signal generation means 8 performs conversion to said pulse train.
[0042] In pulse-train record, the wave of said pulse train can be changed and record conditions can be changed in accordance with change of linear velocity. Drawing 9 expresses typically the relation between the record pulse of (b), and the formed pit, when linear velocity is small, and (a) and linear velocity are large. Here, a pulse train presupposes that it optimizes by (a). If a laser beam is irradiated at a disk when linear velocity is slow, temperature will rise comparatively quickly. Therefore, the normal pit is formed in (a). However, since a temperature rise will take time amount if it is going to record by the same pulse train when linear velocity is quick as shown in (b), a pit will become the blunt thing of a standup. Then, continuation luminescence is carried out like (b') beginning to write, and quickly, temperature is raised and it changes into a pulse train which is made to emit light intermittently after that. Then, the same pit as (a) can be formed.
[0043] Moreover, the height of a pulse may be controlled. Other examples of a pulse train are shown in drawing 1010 . By drawing 10 , Pwo is divided into Pwo1 and Pwo2 among Pwo of drawing 8 , Peo, and Pbo3 value, and the wave controlled still more finely is shown. Generally, a record pit becomes the tear type to which it wrote and the end side swelled by ******** in many cases. Then, in order to amend a pit configuration by making quick heating of beginning to write, the aforementioned pulse-train record is performed. In order to perform this still more effectively, the height Pwo1 of the pulse which beginning writes may be written, and may be made higher than Pwo2 of the end. Furthermore, a uniform pit can be formed if each value is changed according to linear velocity.
[0044] In addition, a setup of the parameter of these pulse trains is good also by the approach of giving functionally also by the approach of quoting from a table as mentioned above. Thereby, according to linear velocity, the always optimal pit can be formed also by the record using a pulse train.
[0045] Since it is the same as that of an example 1 about other actuation, detailed explanation is omitted.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The explanatory view showing one example of the optical disk unit of this invention.
[Drawing 2] The explanatory view for explaining other one example of the optical disk unit of this invention.
[Drawing 3] The explanatory view for explaining other one example of the optical disk unit of this invention.
[Drawing 4] The explanatory view for explaining other one example of the optical disk unit of this invention.
[Drawing 5] The explanatory view for explaining other one example of the optical disk unit of this invention.
[Drawing 6] The explanatory view for explaining other one example of the optical disk unit of this invention.
[Drawing 7] The explanatory view for explaining other one example of the optical disk unit of this invention.
[Drawing 8] The explanatory view for explaining other one example of the optical disk unit of this invention.
[Drawing 9] The explanatory view for explaining other one example of the optical disk unit of this invention.
[Drawing 10] The explanatory view for explaining other one example of the optical disk unit of this invention.
[Drawing 11] The explanatory view showing an example of the conventional optical disk unit.
[Description of Notations]
1 Optical Disk
2 Optical Head
3 Signal-Processing Means
4 Synchronizing Signal Generation Means
5 Phase-Comparison Means
6 Low Pass Filter
7 VCO
8 Record Signal Generation Means

9 Laser Driving Means
10 Controller
11 Synchronizing Signal Generation Means
12 Phase-Comparison Means
13 Frequency Comparison Means
14 Main Shaft Motorised Means
15 Main Shaft Motor
16 VCO
17 Clock Generation Means

[Translation done.]

* NOTICES *

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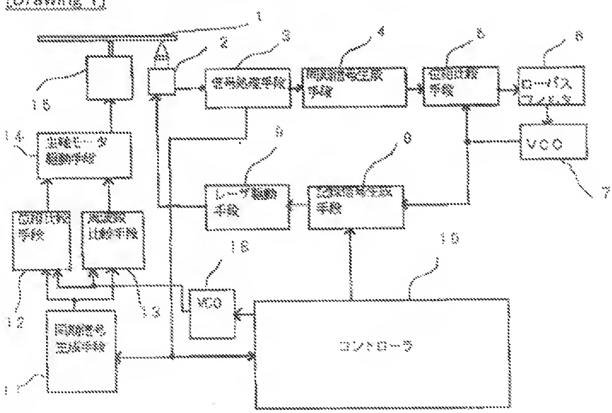
1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.**** shows the word which can not be translated.

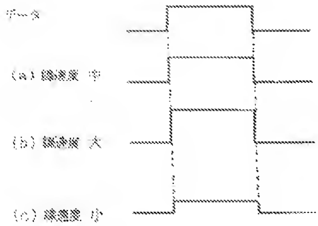
3.In the drawings, any words are not translated.

DRAWINGS

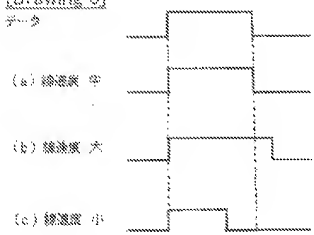
[Drawing 1]



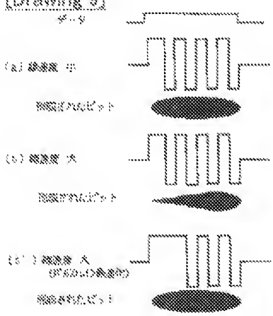
[Drawing 2]



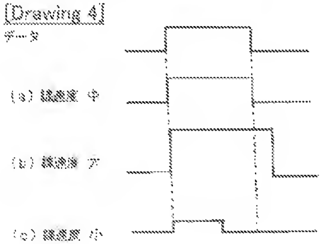
[Drawing 3]



[Drawing 9]



[Drawing 4]

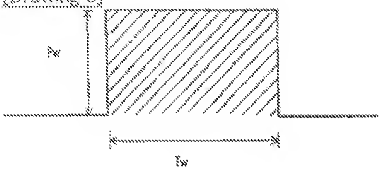


[Drawing 5]

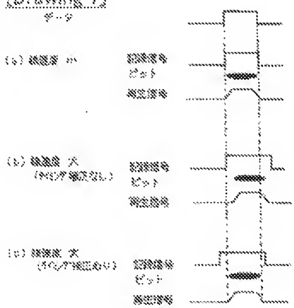
線速度 (m/s)	9.6	10.8	12.0	13.2	14.4
Pw/ΔTw (mW/ns)	10.0/+0	11.0/+2	12.0/+4	13.0/+6	14.0/+8

(ΔTwは、パルス幅の加算値を示す)

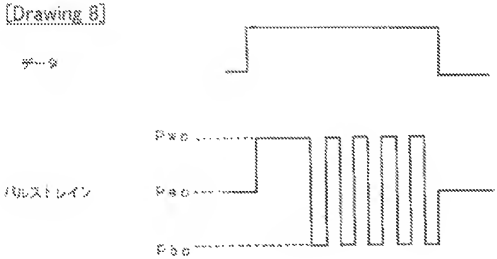
[Drawing 6]



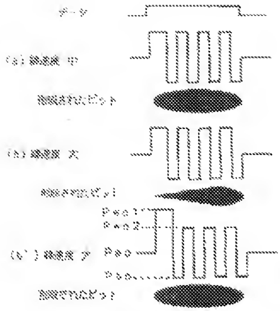
[Drawing 7]



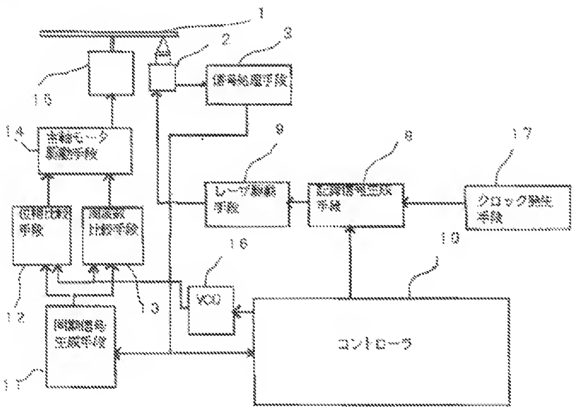
[Drawing 8]



[Drawing 10]



[Drawing 11]



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(71)出願人　000002369
セイコーエプソン株式会社
東京都新宿区西新宿2丁目4番1号

(72)発明者　關　秀也
長野県諏訪市大和3丁目3番5号　セイコーエプソン株式会社内

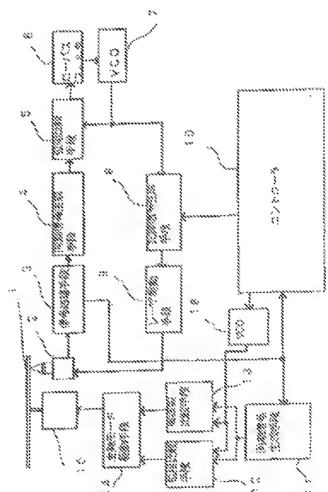
(74)代理人　弁理士　鈴木　喜三郎　（外2名）

(54)【発明の名称】光ディスク装置

(57)【要約】

【課題】高速・高信頼性の記録が可能な光ディスク装置を提供する。

【解決手段】光ディスク装置は、光ディスク１、光ヘッド２、同期信号生成手段４、ＶＣＯ７、位相比較手段５、コントローラ１０、記録信号生成手段８を具備し、線速度に応じて前記記録信号のパルス高さ・幅を変化させ、常に最良の記録条件で記録を行うような構成を有する。



【特許請求の範囲】

【請求項１】線密度一定に記録ピットを形成し、情報の記録・再生を行う光ディスク装置において、光源を含む光ヘッドと、光ディスクの線速度に比例して、線速度が大きいほど周波数が高い基本クロックを生成する基本クロック生成手段と、データ信号を前記基本クロックに同期させて出力する記録信号生成手段と、前記記録信号生成手段の出力に応じて前記光源を発光させる光源駆動手段と、前記光源からピット形成のために前記光ディスクに照射される光の１チャンネルビットあたりのエネルギーを、前記光ヘッドの位置でみた線速度が大きいほど高くし、ピットの大きさを最適にするように制御する制御手段を具備することを特徴とする光ディスク装置。

【請求項２】請求項１において、前記光源の発光波形である前記記録信号のパルスの高さが、前記光ヘッドの位置でみた線速度が小さい時は低く、大きいときは高くなるように制御されることを特徴とする光ディスク装置。

【請求項３】請求項１において、前記光源の発光区間である前記記録信号のパルス幅の基本クロックに対する広さは、前記光ヘッドの位置でみた線速度が小さい時は狭く、大きいときは広くなるように制御されることを特徴とする光ディスク装置。

【請求項４】請求項１において、前記光源からピット形成のために前記光ディスクに照射される光の１チャンネルビットあたりのエネルギーは、前記光ヘッドの位置でみた線速度の平方根に略比例するように制御されることを特徴とする光ディスク装置。

【請求項５】請求項１において、前記光源は前記記録信号に応じて発光し、前記記録信号のパルスの高さは前記光源の出力に相当し、パルス幅は前記光源の発光区間に相当するように構成されており、前記制御手段は、前記光ヘッドの位置でみた線速度に対して最適であるような前記パルスの高さとパルス幅を記述した数表を記憶する記憶手段を有しており、さらに前記線速度に応じて前記数表を参照して段階的に記録パルスの高さと幅を変化させ、常に最適の大きさの記録ピットを形成するように前記記録信号を制御することを特徴とする光ディスク装置。

【請求項６】請求項１において、前記光源は前記記録信号に応じて発光し、前記記録信号のパルスの高さは前記光源の出力に相当し、パルス幅は前記光源の発光区間に相当するように構成されており、前記制御手段は、前記光ヘッドの位置でみた線速度に対して最適であるような前記パルスの高さとパルス幅を与える関数式を記憶する記憶手段を有しており、さらに前記線速度に応じて前記関数式を参照して記録パルスの高さと幅を変化させ、常に最適の記録ピットを形成するように前記記録信号を制御することを特徴とする光ディスク装置。

【請求項７】線密度一定に記録ピットを形成し、情報の記録・再生を行う光ディスク装置において、光源を含む光ヘッドと、光ディスク上に記録された同期情報から、線速度に比例して、線速度が小さい時は周波数が低く、線速度が大きいときは周波数が高い基本クロックを生成する基本クロック生成手段と、データ信号を前記基本クロックに同期させて出力する記録信号生成手段と、前記記録信号生成手段の出力に応じて前記光源を発光させる光源駆動手段と、前記光ヘッドの位置でみた線速度が小さいほど前記記録信号のパルスのタイミングを遅らせ、線速度が変化しても常に最適の位置に記録ピットを形成するように前記記録信号を制御する制御手段を具備することを特徴とする光ディスク装置。

【請求項８】線密度一定に記録ピットを形成し、情報の記録・再生を行う光ディスク装置において、光源を含む光ヘッドと、データ信号を基本クロックに同期させ、さらに多値のパルストレインに変換して出力する記録信号生成手段と、前記記録信号生成手段の出力に応じて前記光源を発光させる光源駆動手段と、前記光ヘッドの位置でみた線速度が大きいほど書き始めのエネルギー量が大きくなるように前記パルストレインの波形を変化させ、常に最適の形状の記録ピットを形成するように前記記録信号を制御する制御手段を具備することを特徴とする光ディスク装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、交換可能な光ディスクを用いた情報記憶装置に関するものである。

【０００２】

【従来の技術】ＣＬＶフォーマットの光ディスクでは、通常主軸モータの回転数をヘッドの位置により変化させ、線速度が一定になるように制御する。即ち、ヘッドが内周にあるときは回転数を高く、外周にあるときは回転数を低くする。一方、記録ピットは線密度一定に形成されている。これにより、光ヘッドで検出される再生信号は、一定の周波数のクロックで読み取ることができる。

【０００３】ところで、前記のような制御では、光ヘッドの位置によって光ディスクの回転数を変化させなければならない。シーク動作は、光ヘッドの移動のみならず回転数の整定をもって完了する。回転数の整定は、場合によって長い時間を要し、しばしばシークタイムを決定する要素になる。こうした回転数の制御を行わずにすめば、シークタイムを短縮することができる。そこで、再生時における高速化を実現するために、特開平０６－８９５０６号や特開平０６－１２７８５号の様に、ディスクの回転数は一定にし、代わりに再生信号検出の基本クロックの周波数を光ヘッドの位置に応じて変化させて高速再生を可能にする方法が提案されている。すなわち、線速度が低くなる内周ではクロック周波数を低く、線速度が高くなる外周ではクロック周波数を高くすれば、回転数一定あるいは少ない幅の変化でもＣＬＶフォーマッ

トのディスクの再生を行うことができる。

【０００４】一方、記録時における高速化を実現するために、特開平０８－２１２６９１号の様に、ディスクの回転数は一定にし、代わりに記録信号の基本クロックの周波数を光ヘッドの位置に応じて変化させて高速記録を可能にする方法が提案されている。その構成の一例を図１１に示す。以下、図に従って従来の光ディスク装置の基本的な動作を説明する。

【０００５】光ディスク装置は、光ディスク１、光源である半導体レーザを用いて前記光ディスク１にレーザ光を照射し情報を記録・再生する光ヘッド２、前記光ヘッド２で読み出した信号を処理しデジタル信号に変換する信号処理手段３、前記光ヘッド２の位置情報に基づいて記録信号の基本クロックを発生するクロック発生手段１７、記録信号の符号やパルス幅、レーザ出力を始め光ディスク装置全体の制御を行うコントローラ１０、前記クロック発生手段１７が発生するクロックと前記コントローラ１０の指令に基づいて記録信号を生成する記録信号生成手段８、前記記録信号生成手段の信号に応じて半導体レーザを発光させるレーザ駆動手段９、前記光ディスクを回転させる主軸モータ１５、前記信号処理手段３の出力から前記主軸モータを所定の回転数で回転させるための同期信号を生成する同期信号生成手段１１、前記主軸モータを一定の回転数で回転させるための基準となる信号を発生するＶＣＯ１６、前記同期信号と前記ＶＣＯ１６の周波数を比較して誤差信号を生成する周波数比較手段１３、前記同期信号と前記ＶＣＯ１６の位相を比較して誤差信号を生成する位相比較手段１２、前記誤差信号に基づいて主軸モータを駆動する主軸モータ駆動手段１４より構成される。本構成では、前記主軸モータの回転数は常に一定であり、代わりに、前記光ヘッド２の半径位置情報に基づいて前記記録信号の基本クロックが内外周で変化し、線密度一定の記録がなされる。ところで、前記の記録方法では、線速度は一定ではないので、均一なピットを形成するために、記録条件を線速度にあわせて最適化しなければならない。特開平０８－２１２６９１号においては、記録条件は記録媒体の特性を内外周で変えて最適化している。

【０００６】

【発明が解決しようとする課題】しかし、記録媒体側で記録条件を最適化する方法は、専用の光ディスクを必要とすることになり、汎用性に乏しい。また、ディスクの回転変動や、ＣＬＶ制御における過渡状態等の、所定の線速度を逸脱した状態で記録可能なように構成された光ディスク装置では、前記の方法では記録条件の最適化ができないという課題を有していた。

【０００７】

【課題を解決するための手段】

（１）本発明の光ディスク装置は、線密度一定に記録ピットを形成し、情報の記録・再生を行う光ディスク装置において、光源を含む光ヘッドと、光ディスクの線速度に比例して、線速度が大きいほど周波数が高い基本クロックを生成する基本クロック生成手段と、データ信号を前記基本クロックに同期させて出力する記録信号生成手段と、前記記録信号生成手段の出力に応じて前記光源を発光させる光源駆動手段と、前記光源からピット形成のために前記光ディスクに照射される光の１チャンネルビットあたりのエネルギーを、前記光ヘッドの位置でみた線速度が大きいほど高くし、ピットの大きさを最適にするように制御する制御手段を具備することを特徴とする。

【０００８】（２）本発明の光ディスク装置は、（１）において、前記光源の発光波形である前記記録信号のパルスの高さが、前記光ヘッドの位置でみた線速度が小さい時は低く、大きいときは高くなるように制御されることを特徴とする。

【０００９】（３）本発明の光ディスク装置は、（１）において、前記光源の発光区間である前記記録信号のパルス幅の基本クロックに対する広さは、前記光ヘッドの位置でみた線速度が小さい時は狭く、大きいときは広くなるように制御されることを特徴とする。

【００１０】（４）本発明の光ディスク装置は、（１）において、前記光源からピット形成のために前記光ディスクに照射される光の１チャンネルビットあたりのエネルギーは、前記光ヘッドの位置でみた線速度の平方根に略比例するように制御されることを特徴とする。

【００１１】（５）本発明の光ディスク装置は、（１）において、前記光源は前記記録信号に応じて発光し、前記記録信号のパルスの高さは前記光源の出力に相当し、パルス幅は前記光源の発光区間に相当するように構成されており、前記制御手段は、前記光ヘッドの位置でみた線速度に対して最適であるような前記パルスの高さとパルス幅を記述した数表を記憶する記憶手段を有しており、さらに前記線速度に応じて前記数表を参照して段階的に記録パルスの高さと幅を変化させ、常に最適の大きさの記録ピットを形成するように前記記録信号を制御することを特徴とする。

【００１２】（６）本発明の光ディスク装置は、（１）において、前記光源は前記記録信号に応じて発光し、前記記録信号のパルスの高さは前記光源の出力に相当し、パルス幅は前記光源の発光区間に相当するように構成されており、前記制御手段は、前記光ヘッドの位置でみた線速度に対して最適であるような前記パルスの高さとパルス幅を与える関数式を記憶する記憶手段を有しており、さらに前記線速度に応じて前記関数式を参照して記録パルスの高さと幅を変化させ、常に最適の記録ピットを形成するように前記記録信号を制御することを特徴とする。

【００１３】（７）本発明の光ディスク装置は、線密度一定に記録ピットを形成し、情報の記録・再生を行う光

ディスク装置において、光源を含む光ヘッドと、光ディスク上に記録された同期情報から、線速度に比例して、線速度が小さい時は周波数が低く、線速度が大きいときは周波数が高い基本クロックを生成する基本クロック生成手段と、データ信号を前記基本クロックに同期させて出力する記録信号生成手段と、前記記録信号生成手段の出力に応じて前記光源を発光させる光源駆動手段と、前記光ヘッドの位置でみた線速度が小さいほど前記記録信号のパルスのタイミングを遅らせ、線速度が変化しても常に最適の位置に記録ピットを形成するように前記記録信号を制御する制御手段を具備することを特徴とする。

【0014】(8)本発明の光ディスク装置は、線密度一定に記録ピットを形成し、情報の記録・再生を行う光ディスク装置において、光源を含む光ヘッドと、データ信号を基本クロックに同期させ、さらに多値のパルストレインに変換して出力する記録信号生成手段と、前記記録信号生成手段の出力に応じて前記光源を発光させる光源駆動手段と、前記光ヘッドの位置でみた線速度が大きいほど書き始めのエネルギー量が大きくなるように前記パルストレインの波形を変化させ、常に最適の形状の記録ピットを形成するように前記記録信号を制御する制御手段を具備することを特徴とする。

【0015】

【発明の実施の形態】

(実施例1)以下に本発明の実施例を示し、図を用いて説明する。

【0016】図1は、本発明の一実施例である光ディスク装置の構成を示す説明図である。光ディスク装置は、光ディスク1、光源である半導体レーザを用いて前記光ディスク1にレーザ光を照射し情報を記録、再生する光ヘッド2、前記光ヘッド2で読み出した信号を処理しデジタル信号に変換する信号処理手段3、前記デジタル信号から前記光ディスク1上に記録された同期信号を抽出する同期信号生成手段4、記録信号を生成する基本クロックを発生するVCO7、前記同期信号と前記VCOの位相を比較して誤差信号を出力する位相比較手段5、前記誤差信号の低周波成分のみを通過させるローパスフィルタ6、記録信号の符号やパルス幅、レーザ出力を始め光ディスク装置全体の制御を行うコントローラ10、前記VCO7が発生するクロックと前記コントローラ10の指令に基づいて記録信号を生成する記録信号生成手段8、前記記録信号生成手段の信号に応じて半導体レーザを発光させるレーザ駆動手段9、前記光ディスクを回転させる主軸モータ15、前記信号処理手段3の出力から前記主軸モータを所定の回転数で回転させるための同期信号を生成する同期信号生成手段11、前記主軸モータを一定の回転数で回転させるための基準となる信号を発生すると同時に、前記コントローラ10の指令を受けて前記主軸モータ15の目標回転数を決定するVCO16、前記同期信号と前記VCO16の周波数を比較して誤差信号を生成する周波数比較手段13、前記同期信号と前記VCO16の位相を比較して誤差信号を生成する位相比較手段12、前記誤差信号に基づいて主軸モータを駆動する主軸モータ駆動手段14より構成される。

【0017】まず、前記主軸モータ15の駆動系について説明する。前記同期信号生成手段11は、前記周波数比較手段13の出力から前記主軸モータ15を回転させるのに必要な同期信号を生成する。前記同期信号は、前記周波数比較手段13と前記位相比較手段12で前記VCO16の出力と比較され、誤差信号が前記主軸モータ駆動手段14に出力される。前記主軸モータ駆動手段14の出力により、前記主軸モータ15は回転する。ここで前記コントローラ10は、前記信号処理手段3の出力信号を受けて、その物理アドレス情報から、前記光ヘッド2の位置を認識している。更に、前記光ヘッド2の位置に応じて前記主軸モータ15の回転数を変化せしめるように前記VCO16を制御する。即ち、前記光ヘッド2が内周にあるときは前記主軸モータ15の回転数を高く、前記光ヘッド2が外周にあるときは前記主軸モータ15の回転数を低くし、内外周で線速度が一定になるように制御する。これは、従来のCLV制御と同じである。

【0018】次に、記録信号生成系について説明する。まず前記信号処理手段3の出力は、前記同期信号生成手段4に入力される。ここで、記録信号を前記光ディスク1上の正しい位置に所定の周波数で記録するために必要な同期信号が生成される。前記VCO7は、前記記録信号の基本クロックを発生する。前記位相比較手段5は、前記基本クロックと前記同期信号の位相を比較し、誤差信号を出力する。前記ローパスフィルタ6は、前記誤差信号の低域のみを通過させ、前記VCO7に供給する。前記VCO7は十分広いキャプチャレンジを持っており、前記光ディスク1の線速度に広い範囲で追従する。よって、前記VCO7の出力周波数は前記同期信号に同期しており、前記光ヘッド2の位置での線速度が速くなれば高く、遅くなれば低くなるように制御される。ここで前述のように、本実施例では本来前記線速度は一定になるように制御されるが、シーク時の前記光ヘッドの移動に伴う回転数の変更には時間を要するため、過渡状態における線速度は所定値を逸脱している。しかし、前記VCO7は広い範囲でこの線速度変動に追従するので、前記回転数が安定する前に記録動作を開始することが可能になり、書き込みに要する時間を短縮することができる。

【0019】さらに前記VCO7のキャプチャレンジが広ければ、CAV制御でも線密度一定の記録が可能である。

【0020】なおここでいう前記同期信号とは、たとえばプリピット領域の同期パターンから得られるものである。即ち、ある種の記録可能な光ディスクでは、あらか

じめ信号再生に必要な基本クロックを生成するのに用いられる同期パターンが凹凸ピットで記録されている。記録時でも、これを読むことにより、線速度に比例した同期信号を得ることができる。また、別のある種の光ディスクでは、ディスク上のピットを形成する溝（グルーブ）が一定周期で蛇行している（ウォブリング）。このようなウォブリングされたディスクならばウォブル信号を逓倍することによって同期信号を生成してもよい。

【0021】前記記録信号生成手段8は、前記VCO7の出力を基本クロックとして、前記コントローラ10からの記録データから記録信号を生成する。前記半導体レーザは、前記記録信号に応じて発光する。ここで、ディスク全面にわたって均一な記録ピットを形成するためには、前記半導体レーザからピット形成のために前記光ディスクに照射される光の1チャンネルビットあたりのエネルギーは、線速度に応じて制御されなくてはならない。即ち、前記光ヘッドの位置でみた線速度が小さい時は低く、大きい時は高くするように制御されなくてはならない。これも前記コントローラ10によっておこなわれる。

【0022】具体的な方法の一つとして、前記半導体レーザの出力を表す前記記録信号のパルスの高さを変える方法がある。この様子を図1及び図2を参照しながら説明する。まず、前記線速度は、図1の前記コントローラ10で認識されている。たとえば、中程度の線速度における記録パルスを（a）とする。より大きな線速度である場合（b）、前記コントローラは前記記録パルスの高さを高くして、より強いレーザ光を光ディスクに照射する。一方、より小さな線速度である場合（c）、前記コントローラは前記記録パルスの高さを低くして、より弱いレーザ光を光ディスクに照射する。この制御により、ディスクの全面にわたり均一な大きさの記録ピットを形成することができる。

【0023】（実施例2）図3は、本発明の他の一実施例を説明するための説明図である。均一な記録ピットを形成するために、実施例1では前記記録信号のパルスの高さを変えたが、本実施例で示すように、パルスの基本クロックに対する幅を線速度に応じて操作してもよい。すなわち、線速度が速くなれば発光パルス幅をより長く、遅くなれば短くするように制御する。この様子を図3を参照しながら説明する。たとえば、中程度の線速度での記録パルスを（a）とする。より大きな線速度である場合（b）、前記コントローラは前記記録パルスの幅を大きくして、より長い時間レーザ光を光ディスクに照射する。一方、より小さな線速度である場合（c）、前記コントローラは前記記録パルスの幅を小さくして、より短い時間レーザ光を光ディスクに照射する。この制御により、ディスクの全面にわたり均一な大きさの記録ピットを形成することができる。

【0024】他の動作については実施例1と同様であるので、詳しい説明は省略する。

【0025】（実施例3）図4は、本発明の他の一実施例を示す説明図である。均一な記録ピットを形成するために、前記記録信号のパルスの高さと幅の両方を線速度に応じて操作してもよい。すなわち、線速度が速くなれば記録パルスの高さを高く、幅をより長く、遅くなれば記録パルスの高さを低く、幅を短くするように制御する。この様子を図4を参照しながら説明する。たとえば、中程度の線速度での記録パルスを（a）とする。大きな線速度である場合（b）、前記コントローラは前記記録パルスの高さを高く、幅を大きくして、より強いレーザ光を長い時間光ディスクに照射する。一方、小さな線速度である場合（c）、前記コントローラは前記記録パルスの高さを低く、幅を小さくして、より弱いレーザ光を短い時間光ディスクに照射する。この制御により、より適切な記録ピットを形成することができる。

【0026】前記の制御を実現するには、記録パルスの高さあるいは幅を、線速度をパラメータとする関数として前記コントローラに記憶させておけばよい。あるいは、線速度に対する数表として前記コントローラに記憶させておいてもよい。たとえば、各線速度に対する前記記録パルスの高さと幅の最適値を求め、これを記述した、図5に示すような数表を前記コントローラ10の記憶手段に格納する。前記線速度が変化する度に前記コントローラ10は前記数表を参照し、段階的に記録条件を変更するように構成すればよい。

【0027】尚、前記関数や数表は、事前に実験で求め、固定された値として装置製造時に記憶してもよい。しかし、より柔軟に使用環境に対応するために、ディスクの試し書き領域を使って前記関数や数表を求めてもよい。すなわち、ディスク挿入時に試し書き領域で記録条件を変化させて試し書きを行い、最適条件をその都度求めて前記記憶手段に記憶するように構成する。この方法では、記録時の周囲温度やディスク、光ヘッドのバラつきを含めた補償が可能になる。

【0028】他の動作については実施例1と同様であるので、詳しい説明は省略する。

【0029】（実施例4）図6は、本発明の他の一実施例を説明するための説明図である。一般に、光スポットが光ディスク上を走査する場合、照射されるエネルギーはディスクの線速度の平方根に反比例する。そこで、前記のように前記記録信号のパルスの高さと幅を操作する場合、前記光ディスクに照射される光の1チャンネルビットあたりのエネルギーを、前記光ヘッドの位置でみた線速度の平方根に略比例するように制御してもよい。これを図6を用いて説明する。図に記録パルスの一例を示す。前記記録パルスの高さをPw、幅をTwとする。前記光ディスクに照射される光のエネルギーは斜線で示した面積に比例する。線速度に応じて記録パルスの高さや幅を変える場合、この面積Pw×Twが、線速度の平方

根に略比例するように、パルスの高さあるいは幅あるいはその両方を変化させれば、常に一定の大きさのピットを書くことができる。

【００３０】前記の制御を実現するには、実施例３でも述べたように、記録パルスの高さあるいは幅を、線速度をパラメータとする関数として図１の前記コントローラ１０に記憶させておけばよい。例えば、パルス高さだけでエネルギーを変えるのであれば、線速度をｖ、定数をｋｐとして$Pw = kp\sqrt{v}$となるようにパルスの高さを制御する。また、パルス幅だけでエネルギーを変えるのであれば、ＰＰＭ記録ならば、定数をｋｔとして$Tw = kt\sqrt{v}$となるようにパルスの幅を制御すればよい。また、ＰＷＭ記録ならば、１つの記録パルスの長さをきめるチャンネルビット数をｎ、クロックの倍数で決る１チャンネルビットあたりの基本パルス幅をT0、定数をｋｔ、k0として$Tw = n \cdot T0 + (kt\sqrt{(v)} - k0)$となるようにパルスの幅を制御すればよい。この式は、$kt\sqrt{v0} = k0$なる線速度ｖ0では、$Tw = n \cdot T0$で、パルス幅は単純に基本パルス幅T0のチャンネルビット数倍だが、線速度がｖ0を越えると$kt\sqrt{v}$だけパルス幅を増やすように制御することを意味する。

【００３１】また、前記の制御において、記録パルスの高さあるいは幅は、線速度に対する数表として前記コントローラ１０に記憶させておいてもよい。前記Pw×Twが、線速度の平方根に略比例するように、パルスの高さと幅の値を記述した数表を前記前記コントローラ１０の記憶手段に記憶させておき、前記線速度が変化する度に前記数表を参照し、段階的に記録条件を変更するように構成すればよい。

【００３２】このようにして、線速度の変化に応じたエネルギーで記録を行うようにすれば、常に適正な記録ピットを形成することができる。

【００３３】ところで、前記線速度は、前記コントローラ１０内部において、一般的にはアドレス情報と前記回転数から算出される。しかし、前記同期信号は、線密度一定に記録する光ディスクでは一定間隔に記録されており、その周波数から直接的に線速度を求めることができる。そこで、前記同期信号を周波数－電圧変換したものをもとにして直接的に前記レーザ出力あるいは前記記録パルス幅を決めるように構成してもよい。この方法によれば、より簡単な回路構成で記録条件の適正化を行うことができる。

【００３４】また、前記同期信号を周波数－電圧変換する代わりに、これをカウントして同様に線速度を求めて、デジタル的に同様の動作を行い、直接的に前記レーザ出力あるいは前記記録パルス幅をもとめてもよい。この方法によれば、記録条件の制御をコントローラ内部でデジタル的に処理できるので、部品点数の増加を招かずにすむ。

【００３５】他の動作については実施例１と同様であるので、詳しい説明は省略する。

【００３６】（実施例５）図７は、本発明の他の一実施例を説明するための説明図である。

【００３７】前記記録パルス幅の変更時には、ピットの位置ずれが起こる可能性がある。これについて、図７を用いて説明する。図中で（ａ）、（ｂ）はそれぞれ内周、外周での記録パルスと記録ピットと再生信号の関係を表している。（ｂ）では、（ａ）に比べて線速度が大きいため、加熱により多くのエネルギーを要する。そこで、前述のように相対的にパルス幅を広げて補償を行う。しかし、この操作を行うと、ピットの位置はパルス幅を広げた方向にシフトする。また、ピット形状も変化する。これは再生信号のピークシフトにつながり、ジッタの原因になる。これを補正することができれば、より信頼性の高い記録が可能となる。

【００３８】そこで、前記記録パルス幅の変更と同時に、ピットの書き始めのタイミングを変更するように制御すれば、前記のシフトを補正することができる。すなわち、パルス幅を広げた場合は、同時に書き始めのタイミングを早くして、ピットの位置がずれるのを防止することができる。具体的には、前述の記録条件を決定する数表または関数を、パルスの高さ、幅のみならず、立ち上がりタイミングのパラメータを与えるものに拡張すればよい。（ｂ）に、書き始めのタイミングを補正する操作を加えたのが（ｃ）である。ピットの位置は補正され、（ａ）と同じ再生信号が得られるようになる。これにより、パルス幅を広げて記録条件を最適化した場合のジッタ特性を向上させることができる。

【００３９】他の動作については実施例１と同様であるので、詳しい説明は省略する。

【００４０】（実施例６）図８は、本発明の他の一実施例である光ディスク装置の構成を示す説明図である。

【００４１】記録可能な光ディスクでは、しばしば図８に示すような発光波形を用いたパルストレイン記録が行われる。これは、記録パルスをさらに１／２チャンネルビット等の細かいパルスに分割し、分割数をパルスの長さによって変えて加熱プロファイルを最適化し、ピット形状を整えるものである。また、前記記録パルスの各値、即ちライト・ピーク・パワーＰｗｏ、イレーズパワーＰｅｏ、ライト・ボトム・パワーＰｂｏ等は多値制御される。また、前記パルストレインへの変換は、前記記録信号生成手段８で行う。

【００４２】パルストレイン記録では、前記パルストレインの波形を変更して、線速度の変化にあわせて記録条件を変えることができる。図９は、線速度が小さい場合（ａ）、線速度が大きい場合（ｂ）の、記録パルスと形成されたピットの関係を模式的に表したものである。ここで、パルストレインは（ａ）で最適化されているとする。線速度が遅い場合は、ディスクにレーザ光を照射すると、比較的速く温度が上昇する。よって（ａ）では、

正常なピットが形成されている。しかし（b）のように線速度が速い場合、、同じパルストレインで記録しようとすると、温度上昇に時間がかかるため、ピットは立ち上がりの鈍いものになってしまう。そこで、（b'）のように、書き始めは連続発光させて素早く温度を上昇させ、その後間欠的に発光させるようなパルストレインに変更する。すると、（a）と同様のピットを形成することができる。

【0043】また、パルスの高さを制御してもよい。図10に、パルストレインの他の一例を示す。図10では、図8のＰｗｏ、Ｐｅｏ、Ｐｂｏ３値のうち、ＰｗｏをＰｗｏ１　Ｐｗｏ２に分け、さらに細かく制御された波形を示している。一般に、記録ピットは蓄熱効果により、書き終り側がふくらんだ涙型になる場合が多い。そこで、書き始めの加熱を素早くすることでピット形状を補正するために、前記のパルストレイン記録がおこなわれる。これをさらに効果的に行うために、書き始めのパルスの高さＰｗｏ１を書き終りのＰｗｏ２より高くしてもよい。さらに、線速度に応じて各値を変更すれば、均一なピットを形成することができる。

【0044】なお、これらパルストレインのパラメータの設定は、前記のように数表から引用する方法によっても、関数で与える方法によってもよい。これにより、パルストレインを用いた記録でも、線速度に応じて常に最適なピットを形成することができる。

【0045】他の動作については実施例１と同様であるので、詳しい説明は省略する。

【0046】

【発明の効果】本発明によれば、以下に示す効果がもたらされる。

【0047】（1）請求項１の本発明の光ディスク装置では、前記光源からピット形成のために前記光ディスクに照射される光の１チャンネルビットあたりのエネルギーを線速度に応じて変えるように制御するので、ディスクの全面にわたり均一な大きさの記録ピットを形成することができる。

【0048】（2）請求項２の本発明の光ディスク装置では、記録信号のパルスの高さを線速度に応じて変えるように制御するので、ディスクの全面にわたり均一な大きさの記録ピットを形成することができる。

【0049】（3）請求項３の本発明の光ディスク装置では、記録信号のパルスの幅を線速度に応じて変えるように制御するので、やはりディスクの全面にわたり均一な大きさの記録ピットを形成することができる。

【0050】また、記録信号のパルスの高さと幅の両方を線速度に応じて変えるように制御した場合、、さらにディスクの全面にわたり均一な大きさの記録ピットを形成することができる。

【0051】また、同期信号を周波数－電圧変換したものをもとにして直接的に前記レーザ出力あるいは前記記録パルス幅をもとめた場合、より簡単な回路構成で記録条件の適正化を行うことができる。

【0052】また、前記同期信号をカウントしたものをもとにして直接的に前記レーザ出力あるいは前記記録パルス幅をもとめた場合、記録条件の制御をコントローラ内部でデジタル的に処理できるので、部品点数の増加を招かずにすむ。

【0053】（4）請求項４の本発明の光ディスク装置では、光ディスクに照射される光の１チャンネルビットあたりのエネルギーを、光ヘッドの位置でみた線速度の平方根に略比例するように制御するので、より合理的にディスクの全面にわたり均一な大きさの記録ピットを形成することができる。

【0054】（5）請求項５の本発明の光ディスク装置では、前記光ヘッドの位置でみた線速度に対して最適であるような前記パルスの高さとパルス幅を記述した数表を記憶する記憶手段を有しており、さらに前記線速度に応じて前記数表を参照して段階的に記録パルスの高さと幅を変化させ、常に最適の大きさの記録ピットを形成するように前記記録信号を制御するので、より細やかな記録条件の設定が可能となる。

【0055】（6）請求項６の本発明の光ディスク装置では、前記制御手段は、前記光ヘッドの位置でみた線速度に対して最適であるような前記パルスの高さとパルス幅を与える関数式を記憶する記憶手段を有しており、さらに前記線速度に応じて前記関数式を参照して記録パルスの高さと幅を変化させ、常に最適の記録ピットを形成するように前記記録信号を制御するので、請求項５の光ディスク装置より少ない記憶容量で記録条件を記憶することができる。また、記録条件を連続的に変化させることができる。

【0056】（7）請求項７の本発明の光ディスク装置では、前記記録パルス幅の変更と同時に、パルスの立ち上がりのタイミングを変更するように制御するので、ピットの位置が補正され、ジッタ特性の良好な、より信頼性の高い記録が可能となる。

【0057】（8）請求項８の本発明の光ディスク装置のように、パルストレインを用いた記録においても、波形の選択と各パラメータの設定を変えることにより、常に最適なピットを形成することができる。

【図面の簡単な説明】

【図１】本発明の光ディスク装置の一実施例を示す説明図。

【図２】本発明の光ディスク装置の他の一実施例を説明するための説明図。

【図３】本発明の光ディスク装置の他の一実施例を説明するための説明図。

【図４】本発明の光ディスク装置の他の一実施例を説明するための説明図。

【図５】本発明の光ディスク装置の他の一実施例を説明

するための説明図。

【図６】本発明の光ディスク装置の他の一実施例を説明するための説明図。

【図７】本発明の光ディスク装置の他の一実施例を説明するための説明図。

【図８】本発明の光ディスク装置の他の一実施例を説明するための説明図。

【図９】本発明の光ディスク装置の他の一実施例を説明するための説明図。

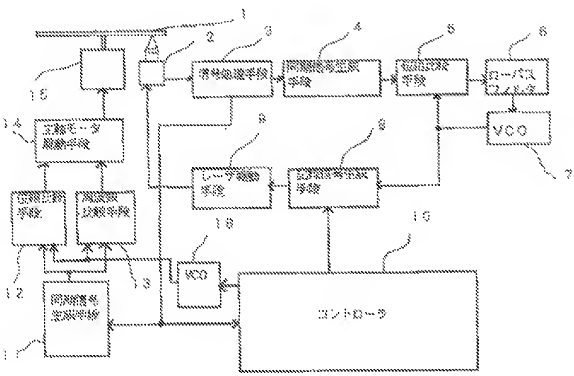
【図１０】本発明の光ディスク装置の他の一実施例を説明するための説明図。

【図１１】従来の光ディスク装置の一例を示す説明図。

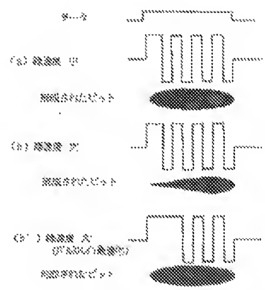
【符号の説明】

１　光ディスク
２　光ヘッド
３　信号処理手段
４　同期信号生成手段
５　位相比較手段
６　ローパスフィルタ
７　ＶＣＯ
８　記録信号生成手段
９　レーザ駆動手段
１０　コントローラ
１１　同期信号生成手段
１２　位相比較手段
１３　周波数比較手段
１４　主軸モータ駆動手段
１５　主軸モータ
１６　ＶＣＯ
１７　クロック発生手段

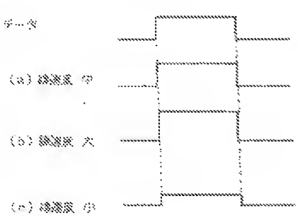
【図１】



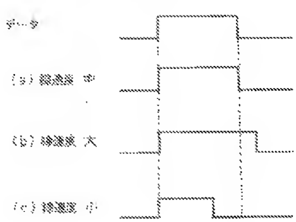
【図９】



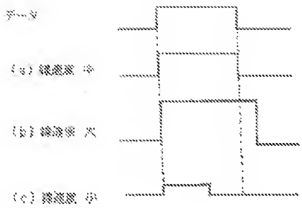
【図２】



【図３】



【図4】

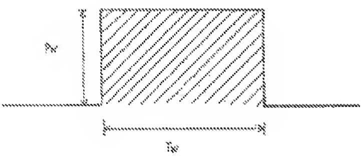


【図5】

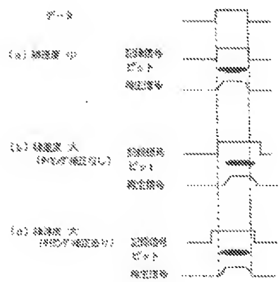
線速度 (m/s)	9.6	10.8	12.0	13.2	14.4
Pw/ΔTw (mW/ns)	10.0/+0	11.0/+2	12.0/+4	13.0/+6	14.0/+8

(ΔTwは、パルス幅の変化量を示す)

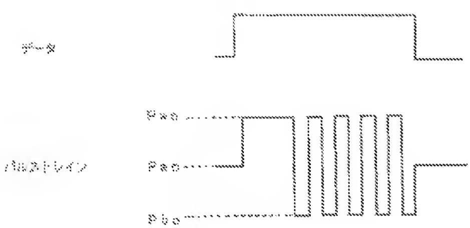
【図6】



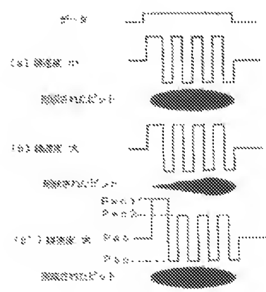
【図7】



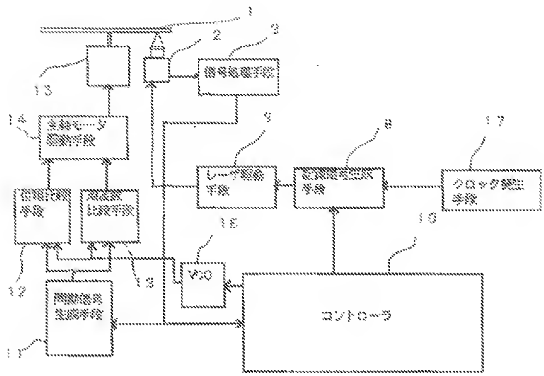
【図8】



【図10】



【図11】


1
2
3
13
14
主軸モータ駆動手段
信号処理手段
9
8
17
レーザ駆動手段
クロック発生手段
16
10
VCO
12
15
11
コントローラ